New ATP Research Directions and Results

Connie Chang and Lorel Wisniewski
Supervisory Economists
Economic Assessment Office

ATP Advisory Committee Meeting
May 13, 2004

New ATP Research Directions & Results

- Survey of ATP Joint Ventures
- Hot-Spot Cluster Analysis
- Improving Our Infrastructure
- University Spinoffs

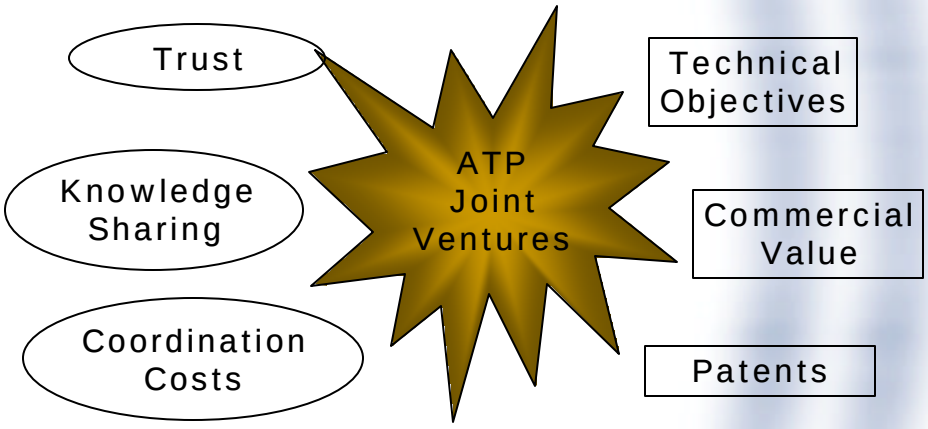
National Institute of Standards and Technology • Technology Administration • U.S. Department of Commerce

Joint Venture Survey
Building on Prior Work

- Case studies – (Link 1997, Printed Wiring Boards)
- Economic Studies – (Sakakibara & Branstetter 2002, Patent Activity; Darby, Zucker, Wang 2002, Project Structure & Outcomes
- Business Reporting System

Dyer & Powell 2001, *Determinants of Success in ATP Funded Joint Ventures*

Joint Venture Survey
Determinants of Success

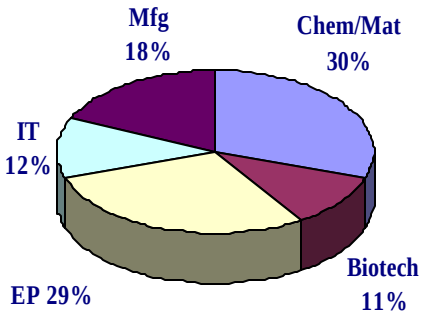


How do we Measure Joint Venture Success?

Joint Venture Survey
Description

- ATP Joint Ventures initiated 1991 – 2001
- 81% response rate
- 397 company respondents
- 142 JV projects

Company respondents by tech area



Close Window

I. Joint Venture Motivation and Formation

Q1. Below are several reasons why a company might choose to participate in an R&D joint venture. Please tell us how important each reason was in your company's decision to partner with other companies in an R&D JV.

		Not important	Somewhat important	Very important	Extremely important
Q1a.	To pool resources with other firms in order to reduce the cost of R&D or achieve a greater scale of effort	(Q1a. = 1)	(Q1a. = 2)	(Q1a. = 3)	(Q1a. = 4)
Q1b.	To benefit from complementary R&D expertise and capabilities of different firms	(Q1b. = 1)	(Q1b. = 2)	(Q1b. = 3)	(Q1b. = 4)
Q1c.	To gain knowledge and learn from other firms	(Q1c. = 1)	(Q1c. = 2)	(Q1c. = 3)	(Q1c. = 4)
Q1d.	To address a technological problem that is common to your industry	(Q1d. = 1)	(Q1d. = 2)	(Q1d. = 3)	(Q1d. = 4)
Q1e.	To access commercialization capabilities of other firms	(Q1e. = 1)	(Q1e. = 2)	(Q1e. = 3)	(Q1e. = 4)

Joint Venture Survey

RESULT

- ATP creates R&D collaboration that would not otherwise occur
- ***92% report the JV would not have formed without ATP***
- ***81% say ATP ensures commitment***
- ***64% say ATP fosters trust & cooperation***

Joint Venture Survey

RESULT

- ATP JV projects represent new R&D directions
- ***77% say project reflects new direction for their company***
- ***83% say project reflects new R&D direction for the industry***

NIST National Institute of Standards and Technology • Technology Administration • U.S. Department of Commerce

Joint Venture Survey

RESULT

- ATP JVs have university connections
- ***68% report project is based on university research***
- ***63% report project involves interaction with universities***

Joint Venture Survey

RESULT

- ATP JVs are more ambitious & more technically difficult than typical R&D
- ***82% report the JV project is more ambitious than typical R&D in their industry***
- ***70% report the JV project involves greater technical difficulty than typical R&D in their company***

NIST National Institute of Standards and Technology • Technology Administration • U.S. Department of Commerce

Joint Venture Survey

- ATP JV projects result in significant commercialization
- ***56% of projects report commercial success through:***
  - ***Product revenues (48%)***
  - ***Cost savings (23%)***
  - ***Licensing revenues (12%)***
- ***80% of projects report additional investment (beyond cost share)***

Joint Venture Survey
Future Work

- Fact sheet series
- Staff research paper
- Dyer et al economic study on Joint Venture Survey analysis
- Incorporate Joint Venture study themes into Business Reporting System

Hot-Spot Cluster Analysis of High Impact Patents

Purpose

Contractor: CHI Research, Inc. (9/02-6/04)

- Motivating Questions: What is the regional impact of ATP? Can we better organize our outreach?
- **Hot-Spot Analysis** is a powerful tool that maps out current areas of innovative activity off the beaten path. This tool:
  - Examines clusters of patents that are highly cited by recently issued patents.
  - Identifies a subset of clusters that are developing early stage technologies most relevant to ATP.
  - Analyzes the regional, organizational, and collaborative characteristics of these clusters.

Hot-Spot Cluster Project

Background

- **Hot-Spot Analysis** provides a filter on recent patents by focusing on the 20% of recent patents that are likely to have impact in the future.
  - Using recent patents with no filtering mechanism is problematic b/c there are >300,000 patents issued in the last 2 years, and most of them may have little value.
  - Need a filter b/c identifying early-stage, high-risk technologies is difficult.

Hot-Spot Cluster Project
Background (II)

- **Hot-Spot patents** can be 1 year old or 25 years old; it does not matter as long as they are highly cited by recent patents.
- High citation is correlated with various measures of impact and quality.
- Very few patents receive many citations. Ones that do represent key technologies that have led to many subsequent innovations.

Hot-Spot Cluster Project
Hot Spot Definition

- A **Hot-Spot Patent** has to have 10+ recent citations, and the proportion of recent cites to total cites is proportional to its age.
  - Old patents have to have 25% of their cites as recent to be hot spots; new patents have to have a higher proportion.

Hot-Spot Cluster Project

Next Generation Definition

- The **Next Generation** (NG) are the current patents building on the hot spot technology (the "citing patents")
  - Patents in a next generation group reference one or more patents in the corresponding hot spot cluster.
  - NG represents lots of patent activity around the same hot technology, usually by many companies.
  - NG are often applications developing around a more basic technology.
  - NG clusters that contain ATP-related patents have certain identifiable characteristics (high public sector participation, high science linkage, and multiple prior art references).

Hot-Spot Cluster Project

Two Period Examination – Trend Analysis

- To test robustness of results, two periods of time were examined:
- 2002 Time Period
  - 16,451 Hot-Spot Patents.
  - 66,216 Next-Generation Patents.
  - 5,455 Next Generation Clusters.
- 1998 Time Period
  - 10,038 Hot-Spot Patents.
  - 43,223 Next-Generation Patents.
  - 2,071 Next Generation Clusters.

Hot Spot Cluster Project Results

Only 20% of all Patents make it to the Next Generation Cluster, but …

47% of ATP-Related Patents are found in the 2002 Next Generation

44% of ATP-Related Patents are found in the 1998 Next Generation

Conclusion: There is a higher than expected association between patents based on ATP projects and Next Generation Clusters.

Hot Spot Cluster Project Results (II)

Next Generation Clusters w/ATP Patents Have a High Degree of Public Sector Participation -- suggests high risk, early stage research

Next Generation Clusters w/ATP Patents Have Twice as Many Science Links as Expected -- suggests high risk, early stage research

Next Generation Clusters w/ATP Patents Have a High Degree of Multiple Prior Art References -- suggests broadly, enabling research

Hot Spot Cluster Project Results (III)

Top 50 Metropolitan Areas (320 total) in terms of Next Generation Patents

Metropolitan Area	Rank and Percent of Total			
	ATP Applications	ATP Awards	Hot-Spot Patents	Next-Gen Patents
San Francisco-Oakland-San Jose, CA CMSA	1 (9.7%)	1 (10.7%)	1 (17.6%)	1 (17.5%)
New York-Northern New Jersey-Long Island, NY-NJ-CT-PA CMSA	4 (6.2%)	3 (6.0%)	2 (9.5%)	2 (7.8%)
Boston-Worcester-Lawrence-Lowell-Brockton, MA-NH NECMA	2 (7.2%)	2 (7.9%)	3 (5.5%)	3 (4.8%)
Los Angeles-Riverside-Orange County, CA CMSA	5 (5.0%)	6 (3.5%)	4 (4.2%)	4 (4.2%)
Boise City, ID MSA	107 (0.1%)	141 (0.0%)	10 (2.4%)	5 (3.5%)
Minneapolis-St. Paul, MN-WI MSA	12 (1.9%)	9 (2.6%)	8 (2.6%)	6 (2.8%)
Chicago-Gary-Kenosha, IL-IN-WI CMSA	9 (2.8%)	8 (2.6%)	5 (2.9%)	7 (2.7%)
Austin-San Marcos, TX MSA	21 (1.1%)	18 (1.3%)	9 (2.4%)	8 (2.7%)
San Diego, CA MSA	7 (3.1%)	10 (2.5%)	6 (2.8%)	9 (2.5%)
Dallas-Fort Worth, TX CMSA	18 (1.4%)	16 (1.9%)	11 (2.2%)	10 (2.4%)
Detroit-Ann Arbor-Flint, MI CMSA	6 (3.7%)	4 (5.1%)	12 (2.1%)	11 (2.2%)
Washington-Baltimore, DC-MD-VA-WV CMSA	3 (6.3%)	5 (4.4%)	7 (2.7%)	12 (2.1%)
Seattle-Tacoma-Bremerton, WA CMSA	19 (1.3%)	22 (1.0%)	14 (1.9%)	13 (2.1%)
Philadelphia-Wilmington-Atlantic City, PA-NJ-DE-MD CMSA	8 (2.8%)	10 (2.5%)	13 (2.1%)	14 (1.9%)
Houston-Galveston-Brazoria, TX CMSA	17 (1.5%)	19 (1.2%)	15 (1.7%)	15 (1.7%)
Portland-Salem, OR-WA CMSA	24 (0.7%)	19 (1.2%)	18 (1.4%)	16 (1.6%)
Raleigh-Durham-Chapel Hill, NC MSA	22 (1.1%)	23 (0.9%)	21 (1.2%)	17 (1.6%)
New Haven-Bridgeport-Stamford-Waterbury-Danbury, CT NECMA	20 (1.2%)	16 (1.9%)	16 (1.6%)	18 (1.5%)
Rochester, NY MSA	29 (0.7%)	23 (0.9%)	17 (1.5%)	19 (1.5%)
Atlanta, GA MSA	13 (1.7%)	21 (1.1%)	20 (1.2%)	20 (1.3%)
Phoenix-Mesa, AZ MSA	27 (0.7%)	38 (0.5%)	22 (1.1%)	21 (1.2%)
Denver-Boulder-Greeley, CO CMSA	11 (2.0%)	14 (2.3%)	19 (1.3%)	22 (1.2%)
Burlington, VT NECMA	164 (0.0%)	141 (0.0%)	35 (0.5%)	23 (0.9%)
Cincinnati-Hamilton, OH-KY-IN CMSA	28 (0.7%)	28 (0.8%)	25 (0.7%)	24 (0.9%)
Cleveland-Akron, OH CMSA	15 (1.6%)	15 (2.0%)	24 (0.9%)	25 (0.8%)

Hot Spot Cluster Project Results (III, cont'd)

Summary of Previous Table

- Boise region is ranked 10th in Hot-Spot Patents and 5th in Next Generation Clusters, but ranked 107th in ATP applications and 141st in ATP awards.
  - Interesting things are going on in Boise, but ATP is not a presence. Patents are mainly from Micron Technologies and HP.
  - Implication of Boise being ranked 5th in Next Generation clusters is that it has an even larger percentage of the very recent developments.
- Similar phenomenon in Burlington VT. Ranked 35th in Hot-Spot Patents and 23rd in Next Generation Clusters, but ranked 164th in ATP applications and 141st in ATP awards.
  - Few ATP applications come from here. Patents are largely driven by an IBM lab.

Hot Spot Cluster Project Results (IV)

Other Results

- Except for a few outliers, existing ATP outreach is hitting the main areas. Pretty good correlation between Hot-Spot regions and ATP applications and awards.
  - San Francisco-Oakland-San Jose, CA is ranked first in ATP apps, ATP awards, Hot-Spot Patents, and Next Generation clusters.
  - Top 10 regions contain 52% of Hot Spots, 43% of ATP apps.
  - Top 20 regions contain 70% of Hot Spots, 60% of ATP apps.
  - Top 30 regions contain 78% of Hot Spots, 69% of ATP apps.
- Some regions are more successful at winning ATP awards than others. Among regions with 10+ ATP awards:
  - Albany-Schenectady-Troy, NY has applied 120 times and won awards 30% of the time.
  - San Francisco-Oakland-San Jose, CA, and Detroit-Ann Arbor-Flint, MI have won awards 18% and 22% of the time.
  - Atlanta, Los Angeles, and Washington, are less successful with only an 11% hit rate, but within the average success rate of 10-12%.

Hot Spot Cluster Project Implications and Next Steps

- Association between ATP-related patents and Next Generation Clusters was found and confirmed for two distinct time periods.
- This finding suggests that ATP is funding technology that is closely linked to high-impact technology.
- With higher than expected participation of ATP-related patents in Next Generation Clusters, ATP dollars are likely to have a broad impact beyond individual award recipients.

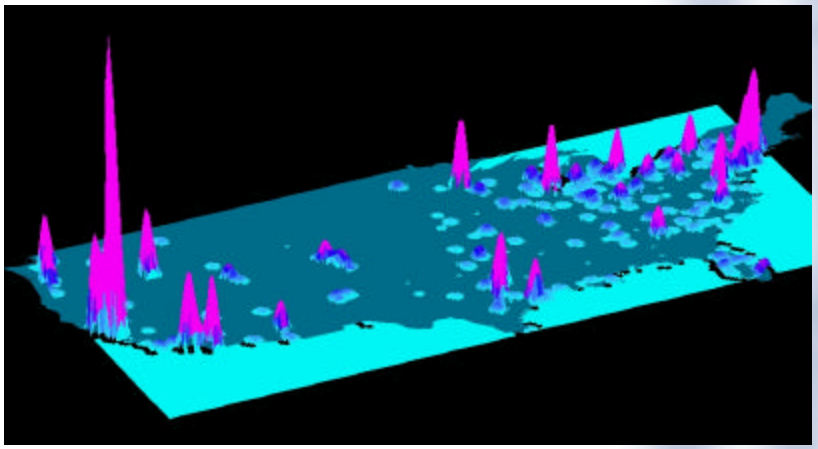
Hot Spot Cluster Project Implications and Next Steps (II)

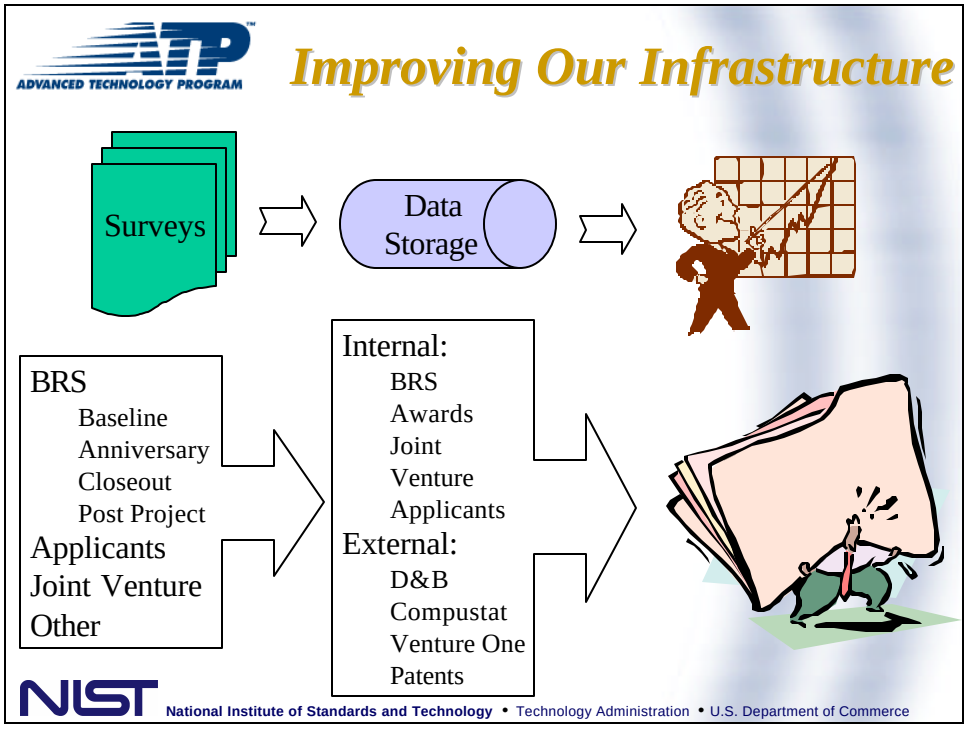
- Project's ultimate goal
  - Of the 300,000+ recently issued patents, identify those that are more closely associated with high risk, early stage technology.
- Next Steps
  - Identify Top 300 Next Generation Clusters based on key characteristics.
  - Down-select to 100 relevant ones and provide general statistics.
  - Narrow down to 60 NG clusters to analyze in detail by geography, inventor, and technology theme.

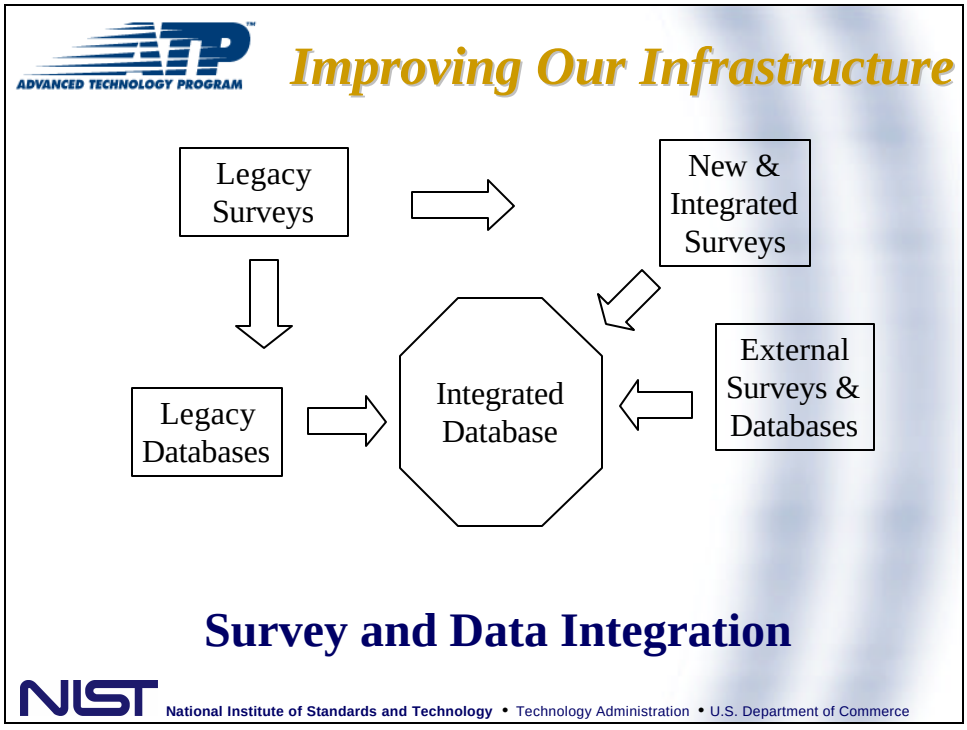
Visualizing Hot Spots

"Understanding Regional Innovative Capacity" Project (10/03-9/05)

Visualization of the 2002 Hot-Spot Patents




ADVANCED TECHNOLOGY PROGRAM
Improving Our Infrastructure
Surveys
Data Storage
BRS
Baseline
Anniversary
Closeout
Post Project
Applicants
Joint Venture
Other
Internal:
BRS
Awards
Joint
Venture
Applicants
External:
D&B
Compustat
Venture One
Patents
NIST
National Institute of Standards and Technology • Technology Administration • U.S. Department of Commerce


ADVANCED TECHNOLOGY PROGRAM
Improving Our Infrastructure
Legacy Surveys
New & Integrated Surveys
Legacy Databases
Integrated Database
External Surveys & Databases
Survey and Data Integration
NIST
National Institute of Standards and Technology • Technology Administration • U.S. Department of Commerce

University Spinoffs

Research Question:

- To what extent do public policies and institutions contribute to the creation of *entrepreneurship capital*?
- To what extent do regional factors shape the formation and direction of entrepreneurship centers?

University Spinoffs

Methodology:

- Interviews with two type of organizations and associated personnel/entrepreneurs
  - Tech-based start ups with university ties
  - State and local institutions (often incubators associated with universities) assisting in entrepreneurial development
  - Indianapolis, Madison, Cleveland, Atlanta, and San Diego

National Institute of Standards and Technology • Technology Administration • U.S. Department of Commerce